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EFFECT OF MULCHING AND IRRIGATION METHODS ON WEED GROWTH AND SOIL MOISTURE PERCENTAGE IN GLADIOLUS

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ABSTRACT

An experiment was conducted at Precision Farming Development Centre, Department of Horticulture, CCS Haryana Agricultural University, Hisar, India during the years 2011-12 and 2012-13, to study the effect of mulching with different irrigation methods on weed growth and soil moisture percentage in gladiolus variety Advance Red. Black polythene mulch was used and weed growth was recorded at monthly intervals where as soil moisture percentage was recorded using portable soil moisture meter at active root zone (5-10 cm depth). The experiment was laid out in RBD with seven treatments and replicated thrice. The results of the experiment revealed that the treatment having Raised beds with drip irrigation and black polythene mulch resulted in significantly minimum weed fresh weight (1.2 and 1.3 g/m^2) over all other treatments. Soil moisture content was higher and maintained an optimum range near active root zone during the entire growth period in drip irrigation and mulching treatment (19-26%) whereas unmulched treatments (13-16%) recorded least soil moisture percentage. It was concluded that mulching with black polythene in drip irrigation significantly helped to conserve soil moisture and to reduce the weed growth in gladiolus.

KEYWORDS: ***Gladiolus, Irrigation, Mulching, Soil Moisture, Weed Growth***

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Original Article

INTRODUCTION

Bulbous plants constitute as one of the most important groups of plants grown for their floral wealth. Gladiolus (*Gladiolus grandiflorus* Ness*)* is considered to be the "queen of bulbous flowers". The genus Gladiolus belongs to family Iridaceae. Gladiolus is cultivated as a commercial cut flower crop in India. In India area under gladiolus cultivation is estimated to be 9.3 thousand ha with a production of 6869.9 lakh cut flowers. Whereas, in Haryana area under gladiolus cultivation is 0.6 thousand ha with a production of nearly 726.9 lakh cut spikes (Anonymous, 2012). Among various factors, irrigation and mineral nutrition are important governing the yield and quality of gladiolus flowers. In Haryana region the ground water level is decreasing day by day and irrigation water supply has become a major area of concern. Water is important for growing of crops and with all efforts 40 percent of the total area is irrigated. Even if all the resources of water are utilized, whole area cannot be irrigated. Irrigation efficiency is only up to the tune of 30-35 percent. Therefore, lots of initiatives are required to apply water in such a manner which can provide maximum output. Use of drip irrigation system along with polythene mulch has been found to be effective for conserving soil moisture besides regulating soil temperature and controlling weeds. However, information on the interactive effect of irrigation and mulching on flower crops is very meager. Keeping the above considerations in view an experiment was carried out to study the effect of different irrigation methods and mulching on weed growth and conservation of soil moisture percentage in gladiolus.

MATERIALS AND METHODS

The experiment was carried out at Precision Farming Development Centre, Department of Horticulture, CCS Haryana Agricultural University, Hisar during the years 2011-12 and 2012-13. The experiment was carried out in randomized block design consisting of seven treatments with three replications. Uniform sized corms of gladiolus cultivar Advance Red were treated with bavistin 0.1% solution for one hour and shade dried before planting. A plot size of 1 m x 1.2 m was made in which 20 corms at a spacing of 30 cm x 20 cm were sown per replication. Black polythene (50 micron thickness) was used for mulching. Mulching was done 30 days after planting. The black polythene was spread over the beds. Corresponding to the position of plant, incisions were given on polythene and plant stems were carefully taken out through the slits to keep the foliage uncovered. The treatments were T_1-Flat bed + Flooding,T_2- Flat bed + Drip irrigation, T_3-Flat bed + Drip irrigation + Mulching,T_4- Raised bed + Furrow irrigation,T_5- Raised bed + Furrow irrigation + Mulching,T_6-Raised bed + Drip irrigation and T_7- Raised bed + Drip irrigation + Mulching. Flooding and furrow type of irrigation were scheduled at fortnight interval at 100%pan evaporation replenishment. Drip system was laid out by 12 mm diameter LLDP lateral pipes, which were aligned in middle of two rows and six drippers per plot with a discharge rate of 2 liters per hour. The plants under drip system were irrigated twice a week at 80% pan evaporation replenishment. Weeds were collected from each experimental plot at monthly intervals and fresh weight was recorded and expressed as weed growth per square meter. The soil moisture percentage was measured at different intervals during the entire growth period using a portable soil moisture meter from a depth of 10 cm.

RESULTS AND DISCUSSIONS

Effect on Weed Growth (Weed Fresh Weight g/m2)

The effect of different irrigation methods and mulching on weed fresh weight is presented in the Table 1. The perusal of data revealed that there was significant difference among the treatments with respect to weed growth. Raised bed with furrow irrigation recorded maximum weed fresh weight (45.0, 30.0 and 27.6 g/m2) followed by flat bed with flooding irrigation treatment (37.0, 18.6 and 16.4 g/m2) at 45, 75 and 105 days after planting, respectively during the year 2011-12. Further perusal of data revealed that treatments with mulching on flat bed recorded minimum weed fresh weight (2.6 g/m2) significantly lower than flat bed and flooding treatment without mulching (37.0 g/m2). Among the mulching treatments, drip irrigation on raised beds showed minimum weed growth (1.8, 0.8 and 1.0 g/m2) at 45, 75 and 105 days after planting, respectively followed by raised bed with furrow irrigation (2.1, 1.3 and 1.0 g/m2) which was at par with each other. Among the irrigation methods furrow irrigation resulted in significantly maximum weed growth than drip and flooding irrigation. Weed growth was higher during the early stages of growth and followed a decreasing trend during the later stages. Similar trend was followed in the year 2012-13.

Weed growth is one of the causes of reduced yields and harbours pests and diseases which ultimately effect the growth and quality of crop grown. Polythene mulch reduces the evaporation of water and transpiration loss, indirectly by smothering weeds underneath and thus conserving soil moisture. In the present studies irrigation methods and mulching showed their significant effect on growth of weeds in gladiolus crop. Sethi (1966) reported that the most outstanding advantage of mulching is the suppression of annual weeds and a consequent saving of labour in cultivation. Weed control has been brought about effectively by the use of black polythene films as mulch, because it cuts off sunlight altogether and weed seedlings underneath become etiolated and die under the mulch. Bahadur *et al*. (2013) reported 25% less weed growth under drip irrigation with 100% volume of water and use of black polythene mulch recorded 80% less weed growth

than control in tomato. Similarly, Jha *et al*. (2013) reported that plastic mulching resulted in significantly less weed biomass production as compared to un mulched treatments in cauliflower-brinjal-tomato cropping system.

Soil Moisture Percentage

Soil moisture percentage was recorded at different intervals during the entire crop period during 2011-12 and 2012-13. It is evident from the values recorded (Table 2, Figure 1 and Figure 2) that drip irrigation and mulching had shown its positive effect on soil moisture conservation in gladiolus. it is evident that during December 2011 soil moisture percentage was higher in drip irrigation on raised bed with mulching (19%) followed by flat bed in drip irrigation with mulching (18%). Furrow irrigation on raised bed recorded minimum soil moisture percentage (14%) among all other treatments. Later during January and February due to very low temperatures and evapo transpiration soil moisture increased in all the treatments as compared to December. Flat bed and flooding recorded maximum (26%) soil moisture during February followed by mulching with raised bed on drip irrigation (25%). All treatments with mulching however resulted in more soil moisture content in the soil in comparison to unmulched treatments. Again during the month of March 2012, with the increasing temperatures and evapotranspiration soil moisture percentage decreased in all the treatments. However, during second week of March 2012 raised bed with furrow irrigation recorded minimum soil moisture (12%) among all other treatments whereas, raised bed with drip irrigation and mulching recorded maximum soil moisture percentage (22%). Similar trend was observed during 2012-13, (Figure 2). As a whole during the entire period of study it is clear that mulching treatments showed their beneficial effect, as all resulted in more moisture content in soil.

CONCLUSIONS

Although raised bed with mulching and drip irrigation maintained its superiority by recording very consistent soil moisture percentage within an optimum range of 18-26%. Flat bed and flooding though recorded maximum soil moisture percentage during February but it did not maintain the consistency and recorded a very fluctuating moisture percentage with a range of (15-26%). Same was the case with furrow irrigated treatments without mulching which recorded very low and erratic soil moisture range of 13-23%. It was further revealed that mulching on raised beds with drip irrigation maintained optimum soil moisture percentage throughout the growth period. Gautam (2002) reported that all mulch treatments were found to be effective in conserving the soil moisture and the magnitude of moisture conservation varied under different mulch treatments as well as with different levels of irrigation in strawberry. The higher moisture content under drip + mulch treatment was attributed to the minimum percolation and evaporation losses and uniform distribution of soil moisture (Dasberg and Steinhardt, 1974). The higher moisture content under mulch treatments as compared to unmulched treatments was due to the fact that water after evaporation condenses on the lower side of the polythene sheet and drips down again on the soil surface. Tiwari *et al.* (1998) and Raina *et al.* (1999) have also shown the usefulness of drip in combination with mulch in soil moisture conservation. Sharma and Kathiravan (2009) in their studies on plum reported that black polythene and bicoloured polythene conserved highest moisture percentage as compared all other mulches and unmulched treatments.

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APPENDICES

Table 1: Effect of Different Irrigation Methods and Mulching on Weed Fresh Weight (G/M2) in Gladiolus

Treatments	Weed Fresh Weight (g/m2)					
	2011-12			2012-13		
	Days after Planting					
	45	75	105	45	75	105
Flat bed + Flooding	37.0	18.6	16.4	37.8	19.2	14.1
Flat bed + Drip irrigation	34.7	15.9	15.5	25.4	15.0	12.4
Flat bed + Drip irrigation + Mulching	2.6	1,8	1.2	3.3	2.6	1.8
Raised bed + Furrow irrigation	45.0	30.0	27.6	43.6	26.5	19.8
Raised bed + Furrow irrigation + Mulching	2.1	1.3	1.0	2.6	2.5	2.0
Raised bed + Drip irrigation	32.1	14.7	11.1	22.0	14.4	10.1
Raised bed + Drip irrigation + Mulching	1.8	0.8	1.0	1.6	1.3	0.9
SEm±	1.0	1.3	0.8	1.1	0.6	0.8
CD (P=0.05)	3.1	4.0	2.6	3.6	1.8	2.4

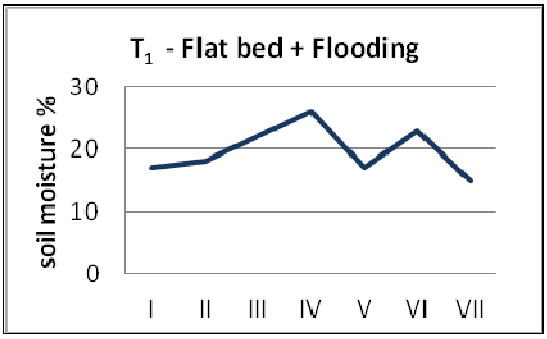
Table 2: Effect of Different Irrigation Methods and Mulching on Soil Moisture Percentage at Different Intervals in Gladiolus

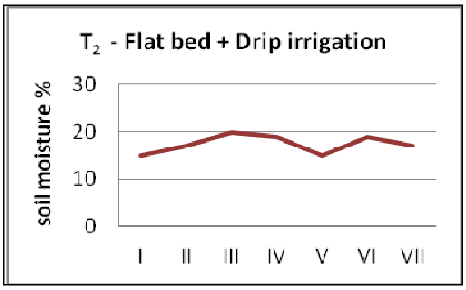
Year	2011-12							2012-13						
Treatments / Date	13/12	06/01	12/01	17/02	22/02	07/03	14/03	12/12	03/01	15/01	13/02	28/02	03/03	12/03
Flat bed + Flooding	17	18	22	26	17	23	15	19	26	17	15	16	23	14
Flat bed + Drip irrigation	15	17	20	19	15	19	17	15	19	18	19	20	19	16
Flat bed + Drip irrigation + Mulching	18	19	21	21	17	20	19	17	21	19	21	22	21	17
Raised bed + Furrow irrigation	14	13	18	23	13	18	12	16	22	15	13	14	20	13

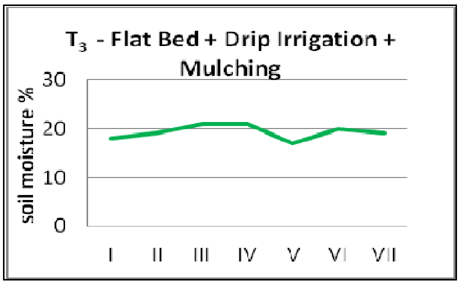
Raised bed + Furrow irrigation + Mulching	16	15	19	24	14	21	13	18	25	16	15	16	22	14
Raised bed + Drip irrigation	17	19	20	22	15	19	18	16	20	17	19	20	19	17
Raised bed + Drip irrigation + Mulching	19	22	21	25	18	22	20	19	26	21	22	23	21	18

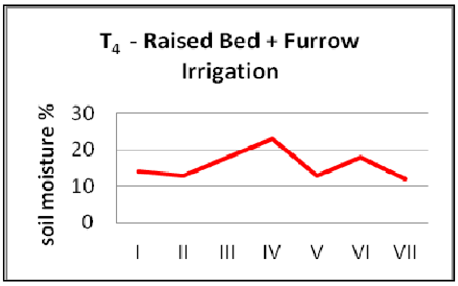
Table 3

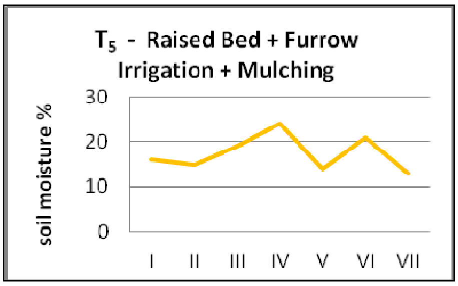
	2011-12	2012-13
I	Dec 13	Dec 12
II	Jan 06	Jan 03
III	Jan 12	Jan 15
IV	Feb 17	Feb 13
V	Feb 22	Feb 28
VI	Mar 7	Mar 03
VII	Mar 14	Mar 12











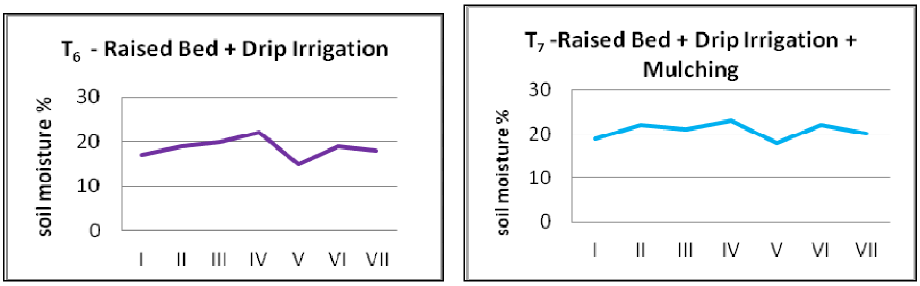


Figure 1: Effect of Different Irrigation Methods and Mulching on Soil Moisture Percentage at Different Intervals in Gladiolus during 2011-12

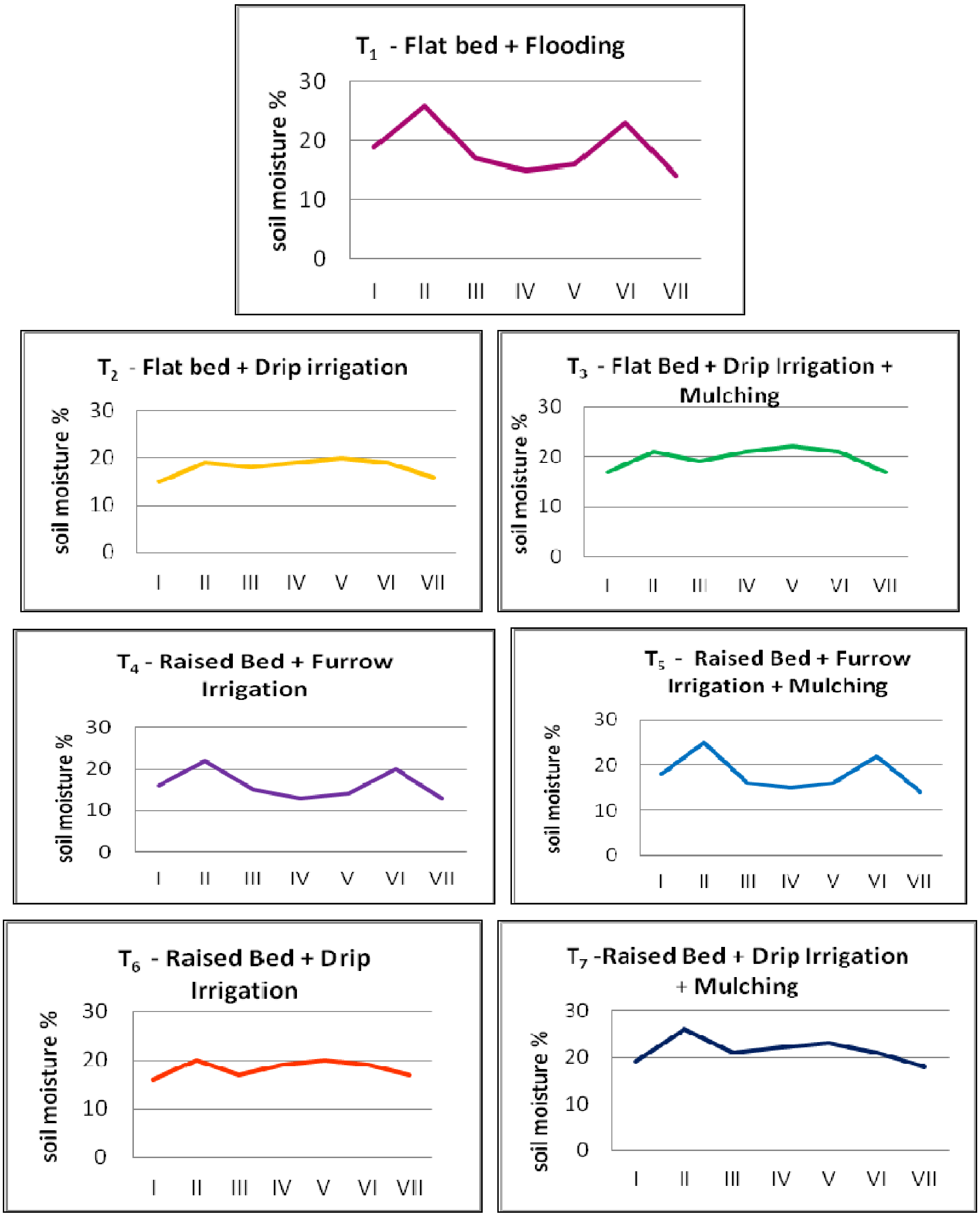


Figure 2: Effect of Different Irrigation Methods and Mulching on Soil Moisture Percentage at Different Intervals in Gladiolus during 2012-13